

Physical Processes Subteam Hypotheses and Metrics

Nov. 20, 2014 9:30-12:00

Attendees: Rosemary Hartman (CDFW), Dave Contreras (CDFW), Trishelle Morris (CDFW), Hildie Spautz (CDFW), Stacy Sherman (CDFW), Alice Low (CDFW), Michelle Orr (ESA), Erik Lobochevsky (DWR), Ramona Swenson (ESA), John Callaway (University of San Francisco, phone), and Tara Morgan (USGS, phone)

Rosemary explained IEP tidal wetland monitoring PWT process thus far – conceptual models, focus on listed fish species and their food web, developed “issues” and “premises” and now our job is to develop specific hypotheses. This group is working off of the Tidal Wetland Restoration Evolution model, based on Suisun Marsh conceptual model.

There was some discussion of the scope of this group in regards to adaptive management. What we monitor will certainly be used to inform adaptive management, but it is not our goal to make recommendations for management action or site design. To this end, we cut any hypothesis that tries to tie outcomes to restoration action or site design.

In terms of how to make this into a useable monitoring plan, the group discussed some sort of decision tree structure that could prioritize what to measure based on budget or question of interest. This will allow the user to determine what method to use based on the precision they need to answer their question.

- **PREMISE 1.1:** Restoring tidal wetlands will influence and be influenced by the Bay-Delta landscape.
 - **Hypothesis 1.1.1:** Restoration site position on ecocline (distance from river channel and ocean, amount of energy input to the system) will effect rates of wetland evolution on the site.
 - **Metrics:**
 - Location of site relative to major riverine inputs and ocean
 - **Hypothesis 1.1.2:** Increased area of tidal marshes will decrease tidal energy.
 - **Metrics:**
 - Tidal excursion
 - Tidal range/ Tidal datums
 - Area of the tidal wetlands
 - **Hypothesis 1.1.3:** Elevation change in restoration sites will be affected by changes in sea level.
 - **Metrics:**
 - Change in relative surface elevation
 - Sea level rise
 - Changes in sediment supply over time

Comment [RKH1]: This is a characterization metric, not a performance metric, it is made up of multiple different characterizations. We should probably brainstorm a list of the most important aspects that we would want to know.

Comment [RKH2]: There are disagreements over scale or extent of this effect. May be different if you plan your restorations differently. May contribute to site selection concerns.

Comment [RKH3]: Tidal datums are contentious in the delta right now.

PREMISE 1.2: Tidal wetland sites of similar ages, elevations, and compositions (e.g. percent vegetation, degree of channelization) will respond to changes in landscape and local attributes in similar ways.

- **Hypothesis 1.2.1:** Inter-annual changes in regional hydrology and climate (and concurrent changes in Delta flows) will affect water quality and on-site physical attributes in restoration sites and nearby wetlands in similar ways.
 - **Metrics:**
 - Annual precipitation (water year type)
 - Annual discharges from Sacramento & other rivers
 - Delta hydrology (inflow and outflow)
 - Water management operations (Delta exports, gate operations, and reservoir releases)
 - Climate patterns (ENSO, climate change)
 - Position of X2
 - Site attributes (water quality, flux of sediment and materials, temperature)
 - Wetland responses (changes in biotic communities)
 - Comparisons between these metrics across sites

Comment [RKH4]: This is also characterization. It is characterization of regional variability.

- **Hypothesis 1.2.2:** Changes in regional sediment loading will affect rate of vertical accretion on site
 - **Metrics:**
 - Regional sediment loading
 - On-site sediment flux
 - Rate of vertical accretion

Comment [RKH5]: Now combined with H1.2.1

Comment [RKH6]: USGS has a lot of sediment data. Sacramento (at Freeport) has had annual sediment loads since the 50s. Also Yolo Bypass, San Joaquin, Mokelumne, Consumnes, have had sediment data for the past few years.

PREMISE 3.1: Restoration of tidal action to wetlands with appropriate elevations and connectivity will encourage the evolution of functional wetland complexes.

- **Hypothesis 3.1.1:** Restoration sites will increase in topographic heterogeneity over time
 - **Metrics:**
 - Length of channels
 - Area of vegetation (emergent, submerged, floating)
 - Characterize topography and bathymetry of the site, including:
 - Area of water by depth class (tells you when fish can access the site)
 - Tidal inundation
 - Upland elevation and area
 - Fancy GIS stats about degree of habitat diversity?
 - **Sub Hypothesis 3.1.1.1:** Restoration sites will change in elevation through sediment deposition and organic matter accumulation (peat formation).
 - **Metrics:**
 - Elevation change (SONAR bathymetry below water, LIDAR for above-water, most difficult in vegetated intertidal that you can't get either of these)
 - Transect surveys

Comment [RKH7]: Patch size, coverage of habitat types, connectivity of habitat types

Comment [RKH8]: Elevation change is our core metric, looking at sediment deposition/loading may be the extra credit. Very important to characterize the baseline conditions

- Sediment loading/flux
- Velocity and tidal excursion at the site, and whether your tides in the site are the same as the surrounding channel (is it fully tidal?)
- Sediment deposition and Peat accumulation (SETs or sediment pins/plates)
- Feltzbar markers for peat accumulation over the longer period of time (but may get washed away if you aren't careful)
- What frequency do we want? How precise do we need?

Comment [RKH9]: This would be the same method as done in the flux group, ADCPs and Sondes with turbidity, accuracy would depend on number of breaches. Could be triggered/opportunistic if you don't see changes in elevation. Tara thinks it is essential, but others think change in elevation is the critical thing, flux is secondary.

Comment [RKH10]: Sediment pins are very affordable, Michelle says they should be on all sites since they are so easy. SETs are more problematic, and only work well in lower flows, plus may be overkill in terms of precision.

▪ **Sub Hypothesis 3.1.1.2:** Channels will develop on restoration sites over time.

- Metrics:
- Length of channels (intertidal and/or subtidal)
- Complexity (number of channel branches)

▪ **Sub Hypothesis: 3.1.1.3:** Vegetation area and community composition will change over time.

- Metrics
- Area of vegetation
- Area of vegetation by type and species
- Vegetation species composition?
- Velocity and tidal excursion at the site, and whether your tides in the site are the same as the surrounding channel (is it fully tidal?)

▪ **PREMISE 4 :** Tidal wetland restoration will change water quality in the restored site and surrounding areas through sequestering, mobilization and/or chemical transformation, in ways that will alter habitat for at-risk fish species.

- **Hypothesis 4.1:** Tidal wetland sites will have greater diversity of microhabitats, and corresponding greater temporal and spatial variability in water quality parameters, than pelagic sites.

Comment [RKH11]: Also might want to think about regulatory requirements for water quality.

Comment [RKH12]: This needs to be massaged. It may be something for the fish team to deal with, since habitat requirements are a fish issue, however the physical processes cause changes in the water quality that changes fish habitat suitability. It's complicated. We may want to develop a table that highlights what organisms each of these parameters is important for.

- **Metrics**
- Temperature
- DO
- pH
- salinity
- turbidity/light availability
- Differences in the above parameters across channels, pannes, vegetation, and open-water habitat in the site.
- Velocity and tidal excursion at the site, and whether your tides in the site are the same as the surrounding channel (is it fully tidal)

Next steps: The FRP team will send out a clean version of these hypotheses and metrics before the next meeting. The group is encouraged to think about existing methods currently in use that might address some of these issues. The next meeting will be Dec. 10

